Interface Reconstruction on General Polygonal Meshes

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Numerical simulation of multiphase or multimaterial in an Eulerian framework often requires tracking of the interface between fluids or phases, variously referred to as volume tracking, interface tracking, and interface reconstruction [1, 2].

We are developing new and efficient means for reconstructing piecewise linear interface representations in complex flow simulations when the volume fractions of the different materials are specified in the elements of the mesh. Our methods are designed to work on general polygonal meshes in 2D and polyhedral meshes in 3D. Moreover, the reconstruction algorithms we are developing are applicable to flow simulations where more than two materials may come together to form a material junction. While previous efforts with multimaterial interface reconstruction require processing of the materials in a user-specified order to get the correct interface topology, we are developing methods which will eventually allow automatic determination of material ordering. Our algorithms are also designed to produce interfaces that are continuous, as far as possible, across element boundaries.

Initial results from the developed procedures indicate that the procedure is fast and reproduces interfaces accurately.

[1] S.J. Mosso, B.K. Swartz, D.B. Kothe, and R.C. Ferrell, "A Parallel, Volume-Tracking Algorithm for Unstructured Meshes," in P. Schiano, A. Ecer, J. Periaux, and N. Satofuka, Eds., *Parallel Computational Fluid Dynamics: Algorithms and Results Using Advanced Computers* (Elsevier Science B.V., 1997) pp. 368–375.
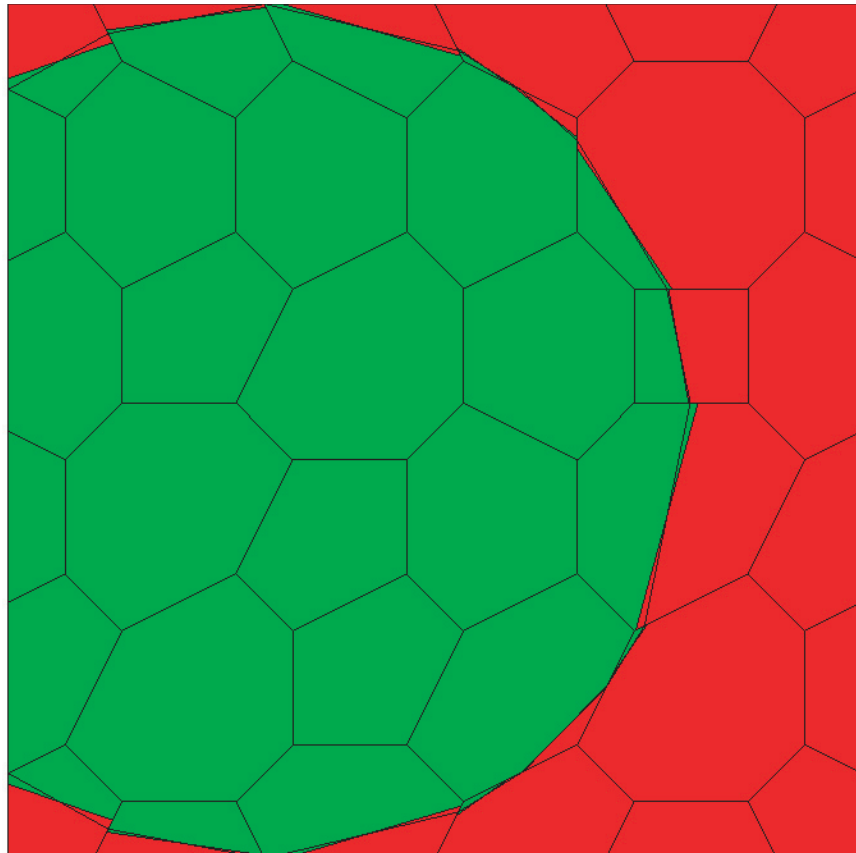
Figure 1—
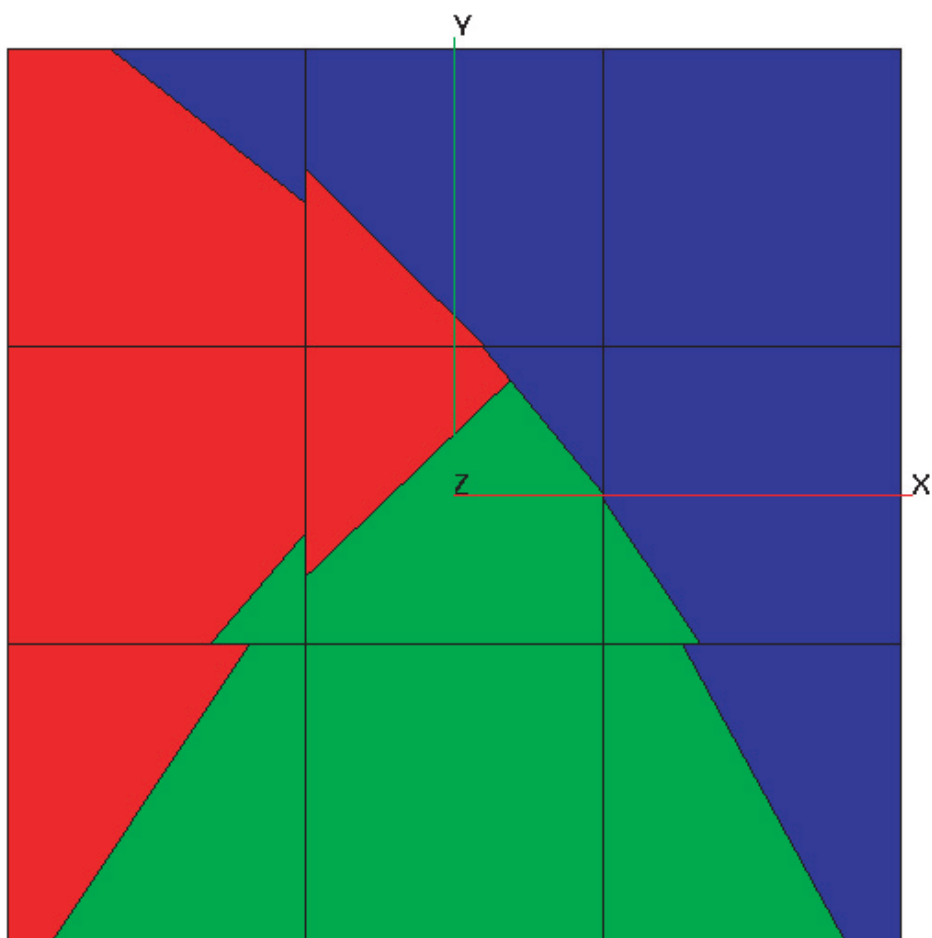*Reconstructed circular interface on a polygonal mesh.*

[2] R.D. Giddings, "HELMIT—A New
Interface Reconstruction Algorithm," in E.F.
Toro, Ed., *Godunov Methods: Theory and
Applications,* (Kluwer Academic / Plenum
Publishers, 2001) pp. 367–376.

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